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RAND RESEARCH ON A DATA-PROCESSING SYSTEM
FOR THE UNITED STATES AIR FORCE

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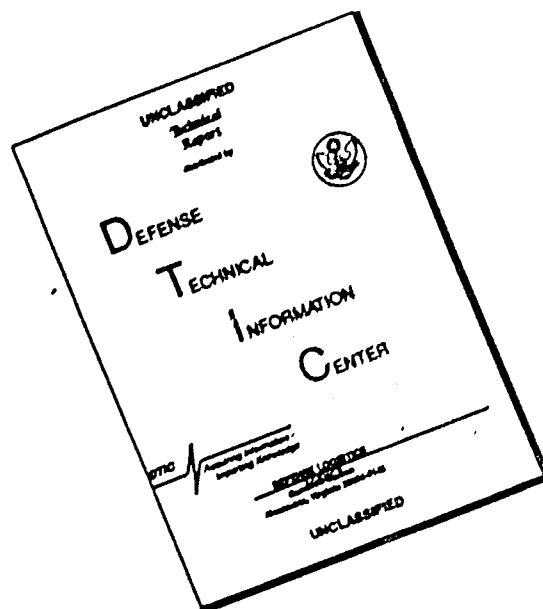
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RAND RESEARCH ON A DATA-PROCESSING SYSTEM
FOR THE UNITED STATES AIR FORCE¹

INTRODUCTION

My presentation is being made at the request of the Air Force to describe the research being done at The RAND Corporation on a logistics data-processing system. This work is part of a larger and comprehensive logistics research program being conducted at RAND. My talk will describe the data-processing system resulting from our research and the status of its development.

Our research is directed towards producing a data-processing system that will meet the needs of the Air Force in the 1960's. At that time, increasing vulnerability will have compelled the Air Force to disperse widely its operating and logistics sites. This dispersion will mean two things:

First, the Air Force stock will have to be spread over many locations, and to all extents and purposes such stocks will be lost in the rest of the system without effective inventory control.

Second, the smaller sites will mean lower and more erratic demands and, consequently, even less chance of predicting demand in requisitioning and setting stock levels. Unless some means of maintaining centralized knowledge of stock is possible, a large increase in inventory will be necessary, with low usage of this inventory.

In addition, the reaction time of combat units to attack must be greatly reduced. This means that a greater proportion of aircraft must be in a combat-ready or flyable status, which will be difficult under dispersed operations.

¹ Presented at a Department of Defense Special Conference on Automatic Data-Processing Systems, 10 April 1956, in Washington D. C. Other reports discussing RAND concepts and work in the logistics data processing area are: A Proposal for a New Air Force Supply Procedure, McNeill, R. B., Berman, E. B., Clark, A. J., Nelson, H. W., The RAND Corporation, Research Memorandum RM-1417, January 24, 1955, and, Research and Development of a New Data-Processing System for Air Force Logistics, Geisler, M. A., Postley, J. A., The RAND Corporation, Research Memorandum RM-1639, February 20, 1956.

The kind of data-processing system the Air Force has in the 1960's will greatly determine both the extent to which the Air Force can operate under these difficult conditions and the cost of logistics support.

ORIGIN

RAND began its research into data processing at the end of 1953. This consisted of a detailed study of the steps involved in the present-day data-processing system at all ZI depots and many Air Force bases. At the same time, we investigated the capabilities of electronic computers and the feasibility of using them for doing the Air Force data-processing job. We also developed a concept of how they might be used in this work.

The result of this many months of study was a report and series of briefings to the Air Force in December, 1954, proposing that the concept developed by RAND be tested in the Air Force environment. This test is known as Project ELECTRO LOGS, and it is being conducted jointly by RAND and the Air Force, both at Santa Monica and the Oklahoma City Air Materiel Area. It is concerned with testing a system for managing aircraft spare parts centrally procured.

CONCEPT

This first chart contains the principles that are the foundation of the proposed data-processing system. These principles were developed by the Air Force and RAND collectively. They have been presented to Secretaries Douglas, Sharp and Gurlock in the Air Force Secretariate and to Generals Irvine and Rawlings. These gentlemen have expressed their approval of these principles as a guide to the development of a revised data-processing system. These principles describe a system that differs basically from the present data-processing system. The physical system built around these principles is shown on the next chart.

The core of the system are several revised Data Processing Centers, each of which contains complete world-wide logistics information on all line items within its responsibility. Each center processes this information in accordance with guidance provided by management, and it provides support to all Air Force activities. This chart emphasizes the first two of the principles. First, the system provides centralized record keeping and data processing. Second, it results in functional separation between stock, records, and management. The importance of this functional separation will be developed a bit later. In other words, the data processing center is a service organization that assists all organizations related to it.

A more detailed picture of the relationships and activities can be gotten from the next chart. The top line of this chart shows the several kinds of management organizations that might deal with a Data Processing Center. Each of these organizations has specialized guidance and data to provide to the DPC, and each in turn receives either general or special reports from the DPC. Thus, all management deals with a single set of consistent and comprehensive records; and by separating management from the records, it becomes feasible for the first time to have the system function effectively with the different management groups, as provided by Principle 9.

The DPC also has relationships with issuing points, that is bases; with stock points, that is supply depots; with repair facilities, that is overhaul depots; and with contractors, to a degree. It maintains current balances of stock positions for all line items within its responsibility as to location (including bases) and condition. It receives reports from these locations as to changes in the status of these stocks. To the maximum extent possible,

the data submitted in these reports will be made uniform, as specified in Principle 6, to increase accuracy and to simplify reporting. Thus, the base reports issues to the DPC which are then used to adjust its balances. Also, the DPC receives reports of repairs accomplished from the repair facility that are reflected in the balances of that location. This separation of the DPC from the stock location will facilitate greatly dispersion of stock without loss of control because as long as the sites report their transactions to the DPC, it will have an up-to-date knowledge of the balances for those items within its responsibility.

The DPC also computes stock control levels and requirements, as specified in Principle 3. In making such calculations, it has current knowledge of total stocks available in the system as specified in Principle 4, and it can use this knowledge in the improved formulas for computing distribution and requirements. It also uses probability distributions wherever possible and appropriate to allow for the uncertainty of demand, as specified by Principle 5. This uncertainty is reduced if the systems can pool demand across bases in making predictions. Our research has also shown that much more effective support can be obtained from stock levels centrally computed. The calculations of stock control levels and reorder points are used by the DPC in determining when resupply of the various issuing points and stock points is required; this results in the preparation of shipping orders as shown on the chart. The requirements calculations made at the DPC provide the master repair schedule and the basis for the procurement directives, also indicated on the chart. Although the data flowing into the DPC will be uniform, it will calculate with these data in different ways depending on the kind of item, price of the item, importance of item, etc., as specified by Principle 7.

The chart emphasizes the many communications contacts that must be maintained among the different parts of the system. An electrical communications system has many advantages which should be exploited if such a system is available for logistics data flow. However, under emergencies, the electrical communications system may be lost. Therefore, the data-processing system must be compatible not only with electrical communications, as specified in Principle 8, but also with manual systems of communications.

ADVANTAGES OF NEW SYSTEM

Now, what benefits will this new system provide? Without detailed discussion, we can say that the following advantages can be expected:

1. Speed
2. Accuracy
3. Concentration of information
4. Computing capability
5. Military effectiveness

First, speed is the best known of advantages. Integrated with a proper communications system, the greater speed of the data-processing equipment will permit large reductions in routine resupply time and permit speeding up in all aspects of logistics operations.

Second, as to accuracy, the data will not only be more current and more complete but they will also be much more accurate. There will be less human and clerical intervention, and the machines will contain many checks and editing routines. Prompt detection of errors will facilitate their correction while they can still be traced.

Third, as to Concentration of information, the great storage capacity of the computer, coupled with its speed, permits concentrating at a single

point all the necessary data on a part or group of parts. This concentration of knowledge provides the means for effective control and management by maximizing the effective use of stock within the system or or minimizing the need for additional stock.

Fourth, as to computing capability, a revised system of information flow will provide greater speed and more comprehensive and accurate logistics knowledge. However, of perhaps equal ultimate value will be the ability of the revised system to perform better kinds of logistics computations. With better computing equipment, it will be possible not only to make the various logistics computations much more frequently, but also to use more comprehensive rules and formulae that take account of more of the factors that need to be considered.

Fifth, as to military effectiveness, I sketched out the probable environment of the data processing system of the 1960's. The proposed system will provide many of the essentials of a logistics structure of that period. Centralization of records will permit dispersal of stock and organization of mobile units with a minimum of difficulty. It will also be possible to have central control of war reserve kits and tables, and to keep them up to date and effective for immediate movement in the event of war. Thus, the new system will help considerably to increase military effectiveness.

DEVELOPMENT OF SYSTEM

What are the major jobs in developing the system? These are shown on the next chart. The sequence of development must be first inventory control, second distribution, and third requirements calculations. The traffic management, financial accounting, and communications jobs cut across the first three jobs and portions of them can be developed concurrently with the former jobs or deferred until the first three jobs are completed.

The inventory control job must come first because it is the base upon which the other jobs depend. It consists of two parts -- first, the operations of the data-processing center and second, the data flow needed by the system for its operation. When the inventory control phase is completed for any group of items, whether they be the parts peculiar to a particular weapon system, or all the parts in the Air Force inventory, the management of that group will be greatly simplified. There will be available at all times current information on the stock of all the items involved, by location, and of the amounts due-in at various future dates from manufacturers and repair facilities. The cataloging and substitutability information on the items will be kept complete and up to date. The required management reports and financial accounts pertinent to inventory control will be available routinely and upon request. All will be computed at one point for the group of items with great accuracy and available on short notice.

In addition, certain operations will be in process in the new system. Using reorder points and reorder quantity information provided to it, the DPC will be directing shipment of items to bases and repair facilities. Proper substitutions will be made, as required by regulation or shortages. Control of in transit shipments will be established.

With the inventory control job done, it is then feasible to introduce the new methods of making distribution and requirements calculations. These calculations can use past demand information and current knowledge of total system stock developed from data in the inventory control phase, which are the crux of any distribution or requirements calculations.

PRESENT STATUS

Work is well under way for developing the inventory control phase. Many of the detailed parts of the procedure have been specified, and machine pro-

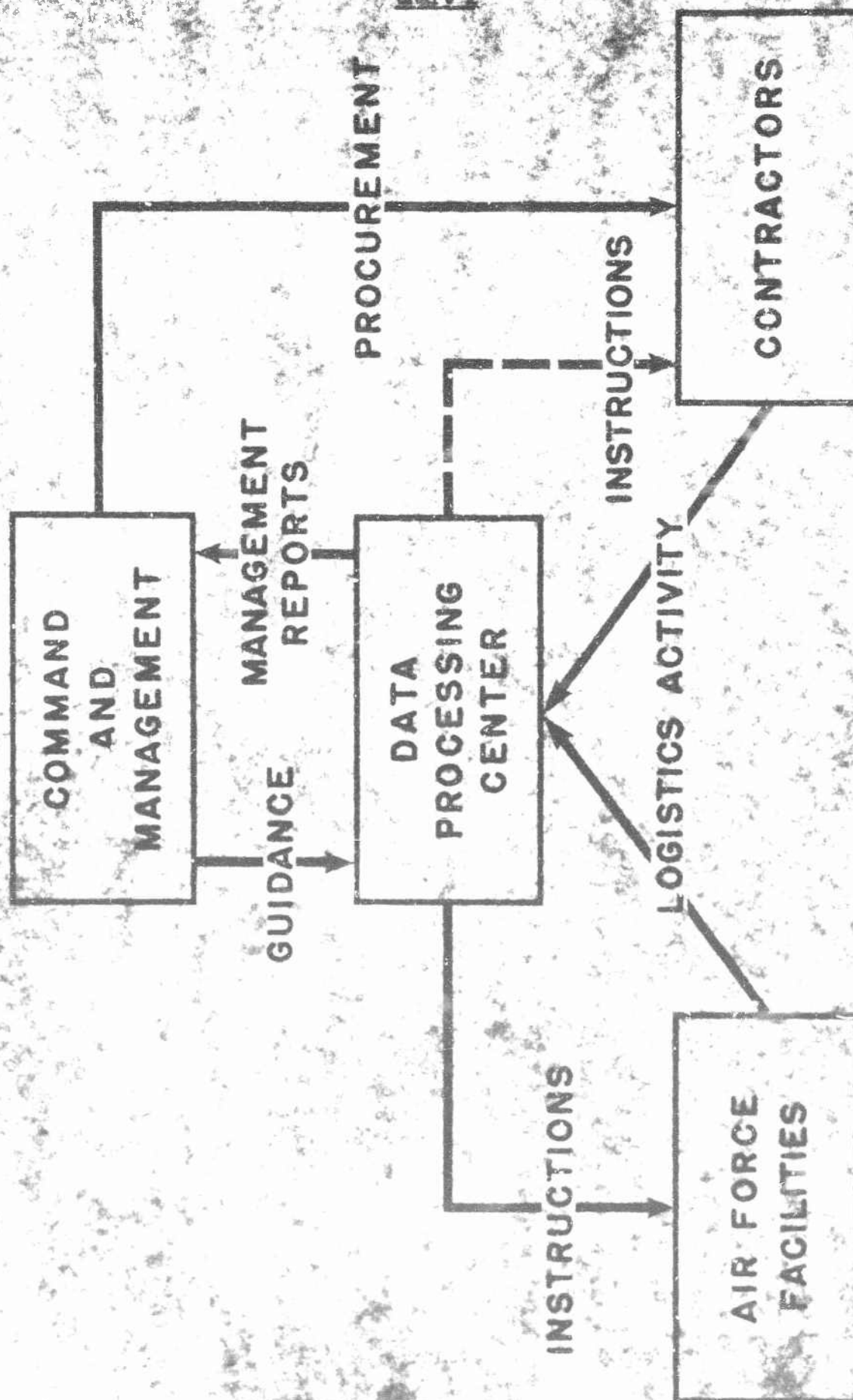
gramming has been begun. Much theoretical work has been done on designing new formulae for computing distribution and requirements. It is planned that this system be tested initially using a single data-processing center, a few bases, perhaps two or three, and a limited number of line items. We hope that from the test will come a defined system which can serve as the guide for the data-processing system of the Air Force in the 1960's.

Tomorrow, Wayne Nelson will describe AF GEN, which has also been a joint Air Force-RAND project, and which is an offshoot of ELECTRO LOGS. AF GEN provides a data-processing system for keeping war reserve tables of aircraft spare parts current under conditions of dispersal. This system is now undergoing operational test within the Air Force.

PRINCIPLES OF PROPOSED SYSTEM

1. CENTRALIZED DATA PROCESSING
2. SEPARATION OF STOCK, RECORDS, AND MANAGEMENT
3. CENTRAL COMPUTATION OF STOCK LEVELS, REQUIREMENTS, ETC.
4. TOTAL STOCK AVAILABLE TO SYSTEM
5. USE OF PROBABILITY FUNCTIONS TO REPRESENT DEMAND
6. STANDARDIZATION OF INPUT DATA
7. DIFFERENTIAL PROCESSING OF DATA
8. COMPATIBLE WITH ELECTRICAL COMMUNICATION SYSTEM
9. COMPATIBLE WITH WEAPONS SYSTEM, CLASS ETC.
MANAGEMENT CONCEPTS

ELEMENTS OF A NEW DATA PROCESSING SYSTEM

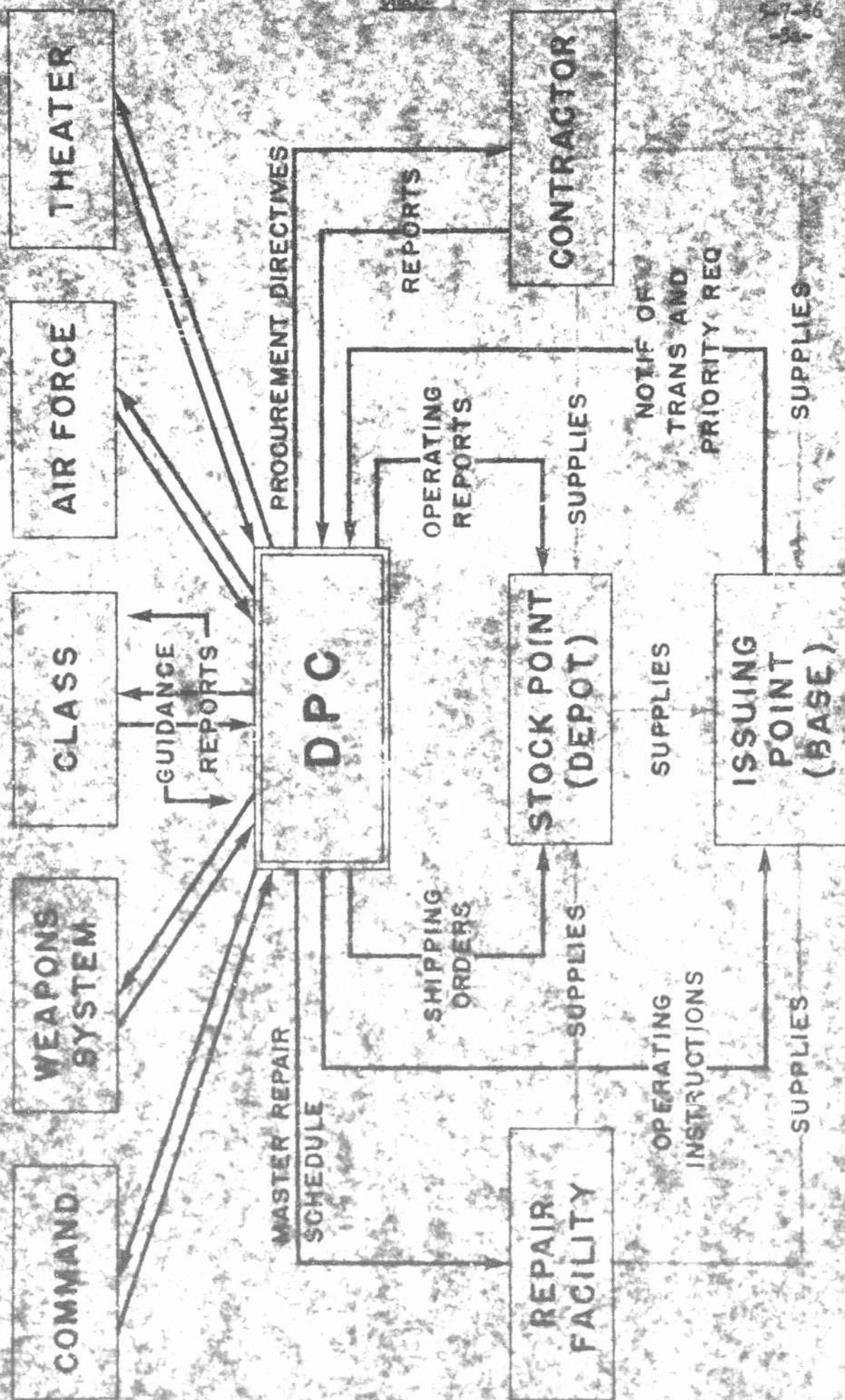


Part 2

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ILLUSTRATIVE DATA PROCESSING SYSTEM



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ADVANTAGES OF REVISED SYSTEM

1. SPEED

2. ACCURACY

3. CONCENTRATION OF INFORMATION

4. COMPUTING CAPABILITY

5. MILITARY EFFECTIVENESS

Part 4

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GEISLER
DA-628

MAJOR JOBS

- 1. INVENTORY CONTROL
 - a. DPC OPERATIONS
 - b. DATA FLOW SYSTEMS

TRAFFIC
MANAGEMENT

COMMUNICATIONS

FINANCIAL
ACCOUNTING

2. DISTRIBUTION CALCULATIONS

3. REQUIREMENTS CALCULATIONS

a. PROCUREMENT

b. MAINTENANCE

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